

### Technical Memorandum Number 17

# Evaluation of the Potential for Bald Eagle Nesting at Silver, Caples and Echo Lakes

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April 2004

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# Evaluation of the Potential for Bald Eagle Nesting at Silver, Caples and Echo Lakes (El Dorado Project, FERC Project No. 184)

#### PURPOSE AND NEED

On 22 February 2000 the El Dorado Irrigation District (EID) submitted an *Application for License for Major Project – Existing Dam* to the Federal Energy Regulatory Commission (FERC) for the El Dorado Project (Project) (EID 2000). The Project includes three high-elevation water storage reservoirs (Silver, Caples, and Echo lakes<sup>1</sup>) located in the Sierra Nevada, California (Figure 1). Table 1 summarizes the physical characteristics of each of these lakes.

Table 1. Physical characteristics of Silver, Caples, and Echo lakes.

		Lake		
Metric	Silver	Caples	Echo	
Elevation at full pool (feet msl, USGS Datum)	7,261.1	7,797.7	7,4411.5	
Total storage capacity (acre-feet)	13,280	22,490	15,749	
Surface area at full pool (acres)	502	624	335	
Mean depth at full pool (feet)	26	36	47	
Maximum depth at full pool (feet)	71	68	150	

Source: Application for License, Volume 4. Exhibit E: Appendix A (10 February 2000).

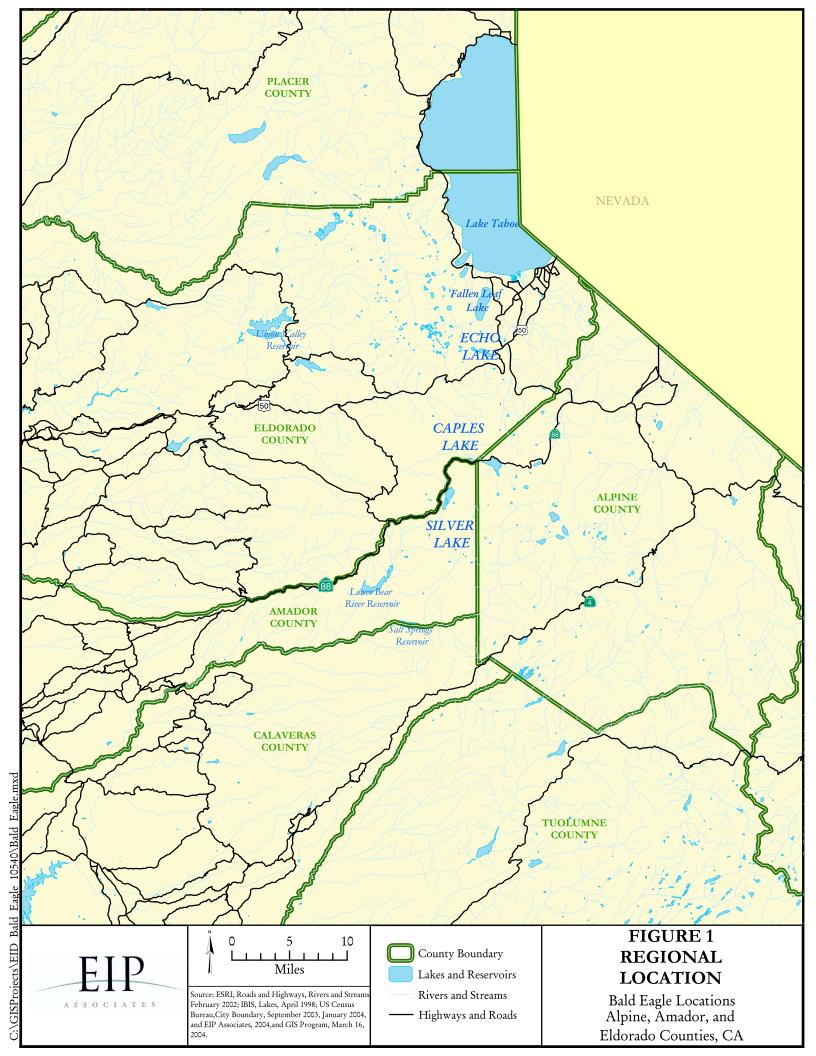
Historical observations and protocol-level bald eagle surveys conducted in 2000 and 2001 have not revealed eagle nesting or evidence of nesting attempts at any of the three lakes (EIP 2002b). FERC requested endangered species consultation with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act on 13 March 2003 (FERC 2003). The USFWS determined that although bald eagle habitat was not expected to be modified as a result of the Project licensing, more information on the status of potential eagle nesting within the Project area was required, as was information on how recreation at the Project lakes might potentially affect eagle use of those lakes (USFWS 2003). This report addresses the USFWS request.

#### **BACKGROUND**

The following bald eagle evaluation chronology (without reference citations) is provided to illustrate the activities conducted as part of the licensing process.

• 22 June 1998. EID issued the Initial Stage Consultation Package (ISCP) to government agencies, the public and other interested parties prior to preparing the *Application for License*.

<sup>&</sup>lt;sup>1</sup> Each of the three lakes was enlarged from its natural size to provide for increased water storage. For information on the pre-project size and habitat conditions at each lake see EIP Associates (2002a).



- 17 September 1998. The California Department of Fish and Game (CDFG) provided comments to FERC on the ISCP. CDFG stated that studies would need to be conducted to evaluate Project impacts on all state and federally listed threatened and endangered species. The bald eagle was not specifically identified.
- 22 September 1998. The U.S. Forest Service El Dorado National Forest (USFS) provided comments to FERC and EID on the ISCP. The USFS specifically requested surveys for bald eagles within suitable nesting habitat surrounding Caples and Silver lakes, but not Echo Lake (see subsequent chronology for rationale for excluding Echo Lake).
- 7 January 1999. USFS issues its *Bald Eagle Habitat Management Plan* for Eldorado National Forest.
- 23 June 1999. USFS faxed bald eagle survey area maps for Caples and Silver lakes to Resource Insights (consultant to EID).
- 6 July 1999. USFWS issued proposed rule to remove the bald eagle from the list of endangered and threatened wildlife in the U.S. (64 FR 36454). The delisting proposal is still pending.
- 8 July 1999. USFS transmitted to Resource Insights the draft survey protocols developed by Eldorado National Forest for bald eagles. Draft habitat maps for Eldorado National Forest were also transmitted. The transmittal letter contained a table that summarized the acreage of potential bald eagle nesting habitat at Echo, Caples, and Silver lakes. The USFS determined that no bald eagle nesting habitat occurred on USFS property at Echo Lake, therefore bald eagle surveys were not proposed.
- 8 September 1999. USFWS requested that FERC initiate formal consultation on Project 184 and *all* its "incremental, interrelated and interdependent actions associated with the Amendment and Relicensing of the Project." The USFWS letter transmitted a threatened and endangered species list for the Project region. The list identified the bald eagle, but no specific bald eagle evaluations were requested.
- 26 October 1999. EID issued the *Draft Application for License* to agencies and interested parties.
- 21 January 2000. CDFG commented to EID on the *Draft Application for License* and repeated the request contained in its 17 September 1998 letter to FERC on the ISCP stating that threatened and endangered species surveys be conducted.
- 21 January 2000. USFS commented to EID on the *Draft Application for License* and stated that bald eagle surveys needed to be completed to protocol.
- 22 February 2000. EID submitted its *Application for License* to FERC. Volume 4 (Exhibit E: Appendix B) summarized the Project impact on bald eagles. The document noted that all the alpine lakes potentially provide summer foraging habitat and concluded that the future operation of the Project would not result in any habitat quality changes for the eagle.

- 15 March 2000. USFS letter to EID stated that the USFS would work with KDH Environmental (consultant to EID) to decide whether to complete helicopter or ground surveys for bald eagles at Caples and Silver lakes. Draft survey protocols would be reviewed and modified if necessary. Surveys would begin with the 2000 field season.
- 20 April 2000. USFS commented to FERC on the *Application for License*. The USFS requested that FERC specify that various incomplete studies be completed.
- 21 April 2000. CDFG commented to FERC on the *Application for License*. No threatened and endangered species comments were included.
- 18 October 2000. CDFG commented to FERC on *Scoping Document 1* for the preparation of an *Environmental Impact Statement* (EIS). No threatened and endangered species comments were provided.
- 20 October 2000. U.S. Department of Agriculture, on behalf of the USFS, provided FERC with preliminary terms and conditions and comments on *Scoping Document 1*. While not specifically addressing the bald eagle, the USFS stated that EID would need to mitigate for impacts from Project operations to threatened and endangered species. Preliminary Condition No. 12 addressed this requirement.
- 25 October 2000. KDH Environmental transmitted the results of the first year of bald eagle surveys to Resource Insights. Sub-adult eagles were observed at both Caples and Silver lakes in 2000. The USFS surveyed Echo Lake in 2000 for California spotted owls and northern goshawks. No bald eagles were observed at the lake by the USFS.
- 2 April 2002. EID issued the summary report for the bald eagle surveys conducted during 2000-2001. Bald eagles were observed foraging at both Silver and Caples lakes during both survey years. No evidence of nesting was observed. No eagles were observed at Echo Lake in either 2000 or 2001.
- 31 July 2002. FERC issued the Ready for Environmental Assessment (REA) notice for Project 184.
- 27 October 2002. USFS submitted preliminary terms and conditions (i.e., Section 4(e) conditions) to FERC in response to the REA. Preliminary 4(e) Condition 40 addressed protections to special-status species during future Project operations.
- 29 October 2002. CDFG submitted Section 10(j) recommendations to FERC in response to the REA. Recommendation 28 addressed protections and consultation procedures for special-status species during future Project operations.
- 7 March 2003. FERC issued the *Draft EIS* for the El Dorado Hydroelectric Project. The *Draft EIS* recognized the non-nesting occurrence of eagles at Caples and Silver lakes, and noted that the resource agencies made no specific recommendations regarding the eagle. USFS Preliminary 4(e) Condition 40 and CDFG 10(j) Recommendation 28 would require EID to prepare a Biological Evaluation prior to construction of any new Project features that might affect the bald eagle. Agency consultation was required. Consequently, FERC

concluded that the ongoing operation of the Project and the proposed changes in lake management were unlikely to affect the foraging suitability of the lakes and, therefore, not adversely affect bald eagles.

- 13 March 2003. FERC requested that the USFWS provide a letter of concurrence with the threatened and endangered species findings presented in the *Draft EIS*.
- 11 August 2003. FERC issued the Final EIS for the El Dorado Hydroelectric Project. FERC's assessment of potential Project impacts on the bald eagle remained unchanged from the *Draft EIS*.
- 26 September 2003. USFWS responded to FERC's request for endangered species consultation and did not concur with the conclusions in the Final EIS regarding Project impacts to the bald eagle.
- 28 October 2003. USFS submitted to FERC its final Section 4(e) conditions. Condition 43 addressed the consultation process with the USFS should any sensitive wildlife species be determined to be impacted by future Project activities.
- 12 November 2003. EID commented to FERC on the USFWS letter to FERC dated 26 September 2003 providing evidence that the USFWS' recommendations to FERC regarding the bald eagle were unwarranted.
- 18 February 2004. A teleconference among FERC, USFWS, EID and EIP Associates (consultants to EID) was conducted. The preparation of a bald eagle technical report was agreed to among all parties.

#### BALD EAGLE DISTRIBUTION IN CALIFORNIA

Figure 2 illustrates the winter and summer range of bald eagles in California.

#### Winter

Bald eagles can be observed throughout much of California during the winter (December- March), except in the desert regions and the high elevations of the Sierra Nevada. By December or January, migrating eagles have arrived on their wintering grounds in California from breeding areas in states and provinces to the north. Hundreds of wintering eagles, about one-half of the wintering population, congregate in the Klamath Basin on the California-Oregon border. Hundreds more are widely distributed over the rest of the state, mainly near rivers, lakes and reservoirs. Winter concentrations diminish from February to April as birds return to their nesting territories in California and winter visitors depart for their nesting areas to the north (Zeiner et al. 1990: 122). Eagles winter at Union Valley Reservoir and possibly other lakes in the Crystal Lakes Basin (Sacramento Municipal Utility District 2004: 10-11), as well as at Lake Tahoe (Orr and Moffitt 1971: 65). Bald eagles do not winter at Caples, Silver or Echo lakes. These lakes are frozen during most of the winter, thus eliminating foraging opportunities.







Not to Scale

Source: Zeiner et al. 1990



Winter Range



Summer Range

## FIGURE 2 BALD EAGLE WINTER AND SUMMER RANGE IN CALIFORNIA

**Bald Eagle Locations** Apline, Amador, and Eldorado Counties, CA

#### Summer

During the summer, resident breeding eagles are restricted mostly to Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou and Trinity counties. One resident pair of eagles has periodically nested successfully at Union Valley Reservoir (4,870.1 feet in elevation at full pool), about 20 miles to the west of Echo Lake (Sacramento Municipal Utility District 2004: 7). Nesting has also been historically reported at Lake Tahoe (6,229.1 feet in elevation at full pool), approximately seven miles to the north of Echo Lake (Orr and Moffitt 1971: 65) (Figure 3). In addition to the nesting records for Union Valley Reservoir and Lake Tahoe, non-nesting summer visitors, both adults and subadults, in the Project region are reported from Silver and Caples lakes (EIP 2002b), Lake Tahoe (Orr and Moffitt 1971: 65), and Loon Lake Reservoir (6,410.0 feet in elevation at full pool) (Sacramento Municipal Utility District 2004: 19-21).

#### Bald Eagle Breeding and Nesting in California

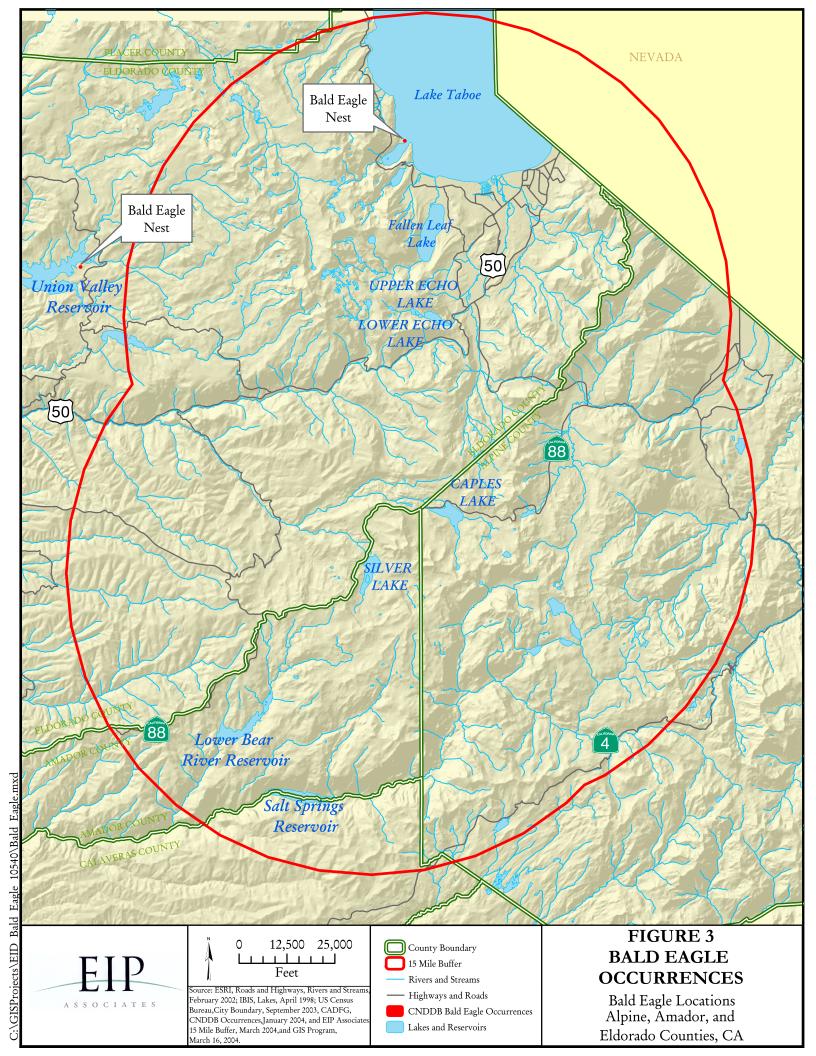
The breeding bald eagle population in northern California is resident year-round in most areas where the climate is relatively mild (Jurek 1988). Bald eagles are more common at lower elevations and uncommon in the higher elevations of the Sierra Nevada (Ron Jurek, California Department of Fish and Game, *pers. comm.*, 17 March 2004; Zeiner *et al.* 1990: 122). Of the 94 bald eagle nests surveyed in California by Lehman (1979: 14), the average bald eagle nest-site elevation was 3,357 feet (range: 1,100 to 7,400 feet).

In California, bald eagle nest sites are always associated with large lakes and reservoirs and large rivers that support abundant fish, waterfowl, or other water bird prey species. Approximately 70 percent of the breeding eagle population in California is associated with water bodies larger than 494 acres (Detrich 1986: 60). One-third of all nests surveyed by Lehman (1979: 13) were within 0.1 mile of a waterfront and 87 percent of the nests were found within one mile of a waterfront, typically in mature and old-growth conifer stands (Buehler 2000) with an unobstructed view of the water. Nests are typically in the tallest or second tallest tree in the surrounding stand (Lehman 1979: 10; Detrich 1986: 43; Jurek 1990), and are most frequently in stands with less than 40 percent canopy closure, but usually with some foliage shading the nest (Call 1978). Most nests are 50 to 200 feet above the ground. In a study of 87 nest trees in California, 87.4 percent of the trees selected by eagles were either ponderosa pine (*Pinus ponderosa*) or sugar pine (*Pinus lambertiana*) (Lehman 1979: 8).

Bald eagles in California produce a clutch of one to three eggs, beginning in March and April (Dave Garcelon, Institute for Wildlife Studies, *pers comm.*, 27 March 2004). Both parents participate in incubating eggs for 34 to 36 days, after which the eggs hatch asynchronously over a one-to-two day period (Ehrlich *et al.* 1988: 220). The young fledge 70 to 98 days after hatching and the breeding cycle is completed after approximately 20 weeks. The resident bald eagle pair at Union Valley Reservoir laid eggs between March 30 and April 2 in 2003, and shortly before March 8 in 2004 (Sacramento Municipal Utility District 2004: 8-9).

#### SUMMARY OF EID BALD EAGLE SURVEYS DURING 2000 AND 2001

Bald eagle surveys were conducted in July and August of 2000, and August and September of 2001, in an effort to determine bald eagle nesting in the vicinity of Caples and Silver lakes. The survey methodology followed the USFS' *Draft Bald Eagle Summer Survey Protocol* (USFS 2000). Six visits were



conducted at each lake each year and were spread over a two-month period. For each survey year, three of the six visits occurred during morning hours (completed prior to 11:00 a.m.) and three occurred during late afternoon (initiated after 2:00 p.m.). No more than two surveys at a given lake were conducted within a single week's time. Each survey visit consisted of observing the lake and surrounding shoreline for a four-hour period. Echo Lake was excluded from the eagle surveys at the direction of the USFS since no eagle nesting habitat was present around the lake. Even though the raptor surveys conducted at Echo Lake did not focus on bald eagle nesting, both the USFS surveyors (2000) and KDH Environmental surveyors (2001) were instructed to record all raptors observed (e.g., osprey). The survey results are summarized in Table 2.

Table 2. Summary of bald eagle survey results for Silver and Caples lakes, 2000 - 2001.

	Survey	Visit		Time	
Site	Year	#	Date	(a.m./p.m.)	Results
Silver Lake	2000	1	7/06/00	a.m.	1 immature (2 yr) bald eagle observed – ospreys present
		2	7/11/00	p.m.	No bald eagles observed – ospreys present
		3	7/14/00	p.m.	No bald eagles observed
		4	8/12/00	a.m.	No bald eagles observed
		5	8/27/00	p.m.	No bald eagles observed – ospreys present
		6	8/28/00	p.m.	No bald eagles observed
	2001	1	8/02/01	p.m.	No bald eagles observed – ospreys present
		2	8/07/01	a.m.	No bald eagles observed – ospreys present
		3	8/13/01	p.m.	No bald eagles observed – ospreys present
		4	8/24/01	a.m.	2 adult bald eagles observed – ospreys present
		5	9/13/01	p.m.	2 adult and 1 immature (2 yr) bald eagles observed -
					ospreys present
		6	9/21/01	a.m.	2 adult bald eagles observed – ospreys present
Caples Lake	2000	1	8/12/00	p.m.	No bald eagles observed
		2	8/27/00	a.m.	1 immature (2 yr) bald eagle observed
		3	8/28/00	a.m.	No bald eagles observed
		4	9/17/00	p.m.	No bald eagles observed – ospreys present
		5	9/22/00	a.m.	No bald eagles observed
		6	9/27/00	a.m.	No bald eagles observed
	2001	1	8/02/01	a.m.	No bald eagles observed
		2	8/07/01	p.m.	No bald eagles observed
		3	8/13/01	a.m.	No bald eagles observed – ospreys present
		4	9/04/01	p.m.	No bald eagles observed
		5	9/14/01	a.m.	No bald eagles observed
		6	9/20/01	p.m.	1 adult bald eagle observed

#### Silver Lake

Two years of bald eagle protocol-level surveys were completed to protocol, with bald eagle presence confirmed at Silver Lake in both 2000 and 2001. The use of the area by bald eagles increased markedly during the late summer and early fall of 2001. No bald eagle nests were observed.

- On the first morning visit in July 2000, one immature (2 year old) bald eagle was observed fishing briefly near the dam at the northern end of Silver Lake.
- During the last three visits in August and September 2001 (both morning and afternoon), multiple bald eagles were observed fishing and roosting in various locations around the lake.
- On one occasion two adults and one immature were seen soaring together over the lake. Two adults were also seen perched together in the same roost tree on more than one occasion.

#### Caples Lake

Two years of bald eagle surveys were completed to protocol, with summer bald eagle presence at Caples Lake confirmed in both 2000 and 2001. No bald eagle nests were observed. Bald eagles were observed at Caples Lake on four additional occasions in 2000 and 2001 during surveys for other species.

- On 28 July 2000 an immature bald eagle was observed roosting at first light in a snag east of the spillway. On the same morning an immature eagle alighted in a snag on the east side of the lake, possibly in response to the broadcast of juvenile goshawk calls.
- On the second visit in August 2000, one immature (2 year old) bald eagle was observed flying from the east across Caples Lake and out of sight over the dam.
- On the morning of 25 August 2001, a juvenile bald eagle was observed flying along the north boundary of the lake and on 10 July 2001, an adult bald eagle flew overhead on the east shore of the lake, again presumably in response to the broadcast goshawk calls.
- In September 2001, an adult bald eagle flew from the west and perched in a large red fir (*Abies magnifica*) on the east side of the lake where it roosted for approximately one hour.

Historically, Eldorado National Forest has also conducted bald eagle surveys at Silver and Caples lakes at various times. Though these data have not been compiled or summarized, the surveys did not reveal the presence of nesting bald eagles at either Silver or Caples lakes (Dawn Lipton, Lake Tahoe Basin Management Unit, *pers. comm.*, 5 March 2004). The Bald Eagle Management Plan issued by Eldorado National Forest on 7 January 1999 summarizes eagle historical bald eagle occurrences on the forest (USFS 1999).

#### BALD EAGLE NESTING EVALUATION METHODOLOGY

The previously summarized information provides an overview of recent bald eagle occurrences and usage at Silver, Caples and Echo lakes. In EID's letter to FERC dated 12 November 2003 (EID 2003: 2), EID stated that the principal reason that bald eagles do not nest at Silver, Caples, and Echo lakes is that the lakes are typically frozen during the initiation of the nesting season, thus eliminating the food supply that must be available. In response, the USFWS requested information on the timing of lake thawing to support EID's contention (Teleconference with Susan O'Brien, FERC, 18 February 2004). To address the suitability of Silver, Caples, and Echo lakes as *potential* eagle nesting habitats, two evaluations were completed. First, the lake thaw analysis requested by the USFWS was

completed for each lake. Second, the U.S. Fish and Wildlife Service's habitat suitability index (HSI) model for bald eagle breeding (Peterson 1986) was applied to the three lakes.

#### Lake Thaw Analysis Model Methodology

The lake thaw analysis was completed for a 38-year period (1966-2003). This period was selected to include a wide range of climatological and hydrological conditions that influence the timing of lake thaw. The lake thaw analysis model relied on: 1) annual records of lake volumes; 2) representative daily stream flow records; and, 3) daily snow sensor data. The specific data sets used were:

- Daily lake volume records for 1966-2003 for the three lakes;
- Representative daily stream flow records for:
  - O South Fork American River near Kyburz, U.S. Geological Survey stream gage #11439500 (elevation 3,840 feet). Flow records: 1966-2003; and,
  - o Pyramid Creek at Twin Bridges, U.S. Geological Survey stream gage #11435100 (elevation 6,320 feet) Flow records: 1971-2003.
- Daily snow-sensor records from the California Data Exchange Center<sup>2</sup> for all stations in the Yuba, American, Consumnes, Mokelumne, and Stanislaus river basins. Data from 23 stations were used to develop a relationship between the onset and end of snowmelt and elevation. Stations most relevant to the lake thaw analysis were:
  - o Silver Lake (elevation 7,100 feet). Snow sensor records: 1987-2003;
  - o Alpha (elevation 7,600 feet). Snow sensor records: 1966-2003; and,
  - o Caples Lake (elevation 8,000 feet). Snow senor records: 1972-2003.

The lake thaw model developed regressions between lake volume, streamflow and snowmelt to determine the onset and end of lake thaw.

#### Breeding Season Habitat Suitability Index Model Methodology

The U.S. Fish and Wildlife Service has developed a series of habitat suitability index models which provide habitat information useful for impact assessment and habitat management. The HSI model results are scaled to produce an index between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). Peterson (1986) prepared a bald eagle breeding season HSI model that was developed for application in habitats north of the 37<sup>th</sup> parallel (i.e., from the latitude of San Jose, California northward). The development of the HSI model will not be repeated in detail in this report (see Peterson (1986) for a detail discussion and rationale for the HSI model); however, the following summary of the methodology is provided.

<sup>&</sup>lt;sup>2</sup> Maintained by the California Department of Water Resources, Division of Flood Management.

The breeding season HSI model for the bald eagle considers food, reproduction and human disturbance as the primary components of breeding habitat. Peterson (1986: 8) states:

"The HSI value considers the quality and availability of nesting sites and the availability of prey. Because eagle prey is primarily derived from aquatic systems, total prey availability is assumed to depend upon the size and productivity of the associated water body. Optimal nesting habitat is assumed to be characterized by: (1) a large foraging area with high fish production, (2) the presence of mature trees for nest sites, and (3) minimal human disturbance."

#### Food Component of the HSI Model

Two variables are used to characterize the suitability of bald eagle habitat for food: 1) the amount of open water and wetlands adjacent to open water (Leighton *et al.* 1979; Whitfield *et al.* 1974); and, 2) the productivity of the water body as measured by the morphoedaphic index (MEI) (Ryder 1965; Jenkins 1982). The suitability index formula for the food component of the HSI is:

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SIF = (SIV1 \times SIV2)^{1/2}
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Where: SIV1 = area covered by open water and adjacent wetlands (square miles); SIV2 = MEI = total dissolved solids (ppm)/ mean depth (feet).

#### Reproduction Component of the HSI Model

Suitable bald eagle nesting habitat within lacustrine habitats is assumed to be a function of the amount of mature, open canopy forest cover within the evaluation area (i.e., one mile of the lake). For this component of the model only one variable is used:

SIR = percent of potential nesting area covered by mature timber.

#### Human Disturbance Component of the HSI Model

Bald eagle populations reach their greatest densities in areas of minimal human activity. Eagles are found in reduced densities in areas of moderate human use and are not found at all in areas of heavy human use. They prefer to nest at least 0.6 mile from human residences and will nest farther from the waterfront to avoid disturbance. One variable is used in this component of the model to measure human disturbance:

SIHD = number of buildings or campsites per square mile of upland evaluation area.

#### HSI Determination

The foregoing model components are combined in a formula to reflect the overall HSI value of a given lake or reservoir. The model assumes that in extreme cases none of the potential food will be used by eagles when either or both of the reproductive or human disturbance components is 0.0. Thus, the combined reproductive/disturbance component is a modifier of the maximum food suitability component. The combined HSI model formula is:

$$HSI = (SIR \times SIHD)^{1/2} \times SIF.$$

The HSI model was applied to Silver, Caples, and Echo lakes to evaluate the potential of these lakes to support breeding eagles *irrespective of the lake thaw results*.

#### RESULTS OF THE BALD EAGLE NESTING EVALUATION

#### Lake Thaw Analysis Model Results

Table 3 summarizes the annual dates for significant snowmelt and the end of the snowmelt season at Silver, Caples, and Echo lakes, as well as the duration of lake thawing. Not surprisingly, Silver Lake, the lowest elevation lake, begins to thaw first. A relatively close correspondence (+/- five days) occurs between the beginning of significant snowmelt (as measured by streamflows at the stream gages) and increases in reservoir volume. Significant snowmelt runoff results in rising lake levels that create open water around the margins of the lakes and at stream inflow points. The snowmelt end date corresponds to the time where nearly all ice on the lakes has melted. The ending date corresponds to the beginning of the growing season for grasses and forbs grazed by certain species of waterfowl that are common prey for eagles. The average time between the beginning and end of snowmelt runoff is 24 days. Echo Lake begins to thaw approximately four days after Silver Lake, and Caples Lake begins to thaw about thirteen days after Silver Lake. Figure 4 illustrates the 38 years of thaw data grouped by week of occurrence.

The data indicate that, typically, Silver and Echo Lakes begin to melt between the second week in April through the second week in May, and Caples Lake typically begins to melt between the last week in April and the last week in May. Conversations with local residents confirm that these dates are accurate, though the lakes occasionally thaw even later than these periods (Silver Lake Resort staff, *pers. comm.*, 16 March 2004; Mike Bumgardner, Bumgardner Environmental, *pers. comm.*, 16 March 2004).

#### Breeding Season Habitat Suitability Index Model Results

Table 4 summarizes the characteristics of Silver, Caples, and Echo lakes for each of the metrics used in the HSI model. In addition, the characteristics of Union Valley Reservoir are included for comparison to a reservoir that supports periodic successful eagle nesting.

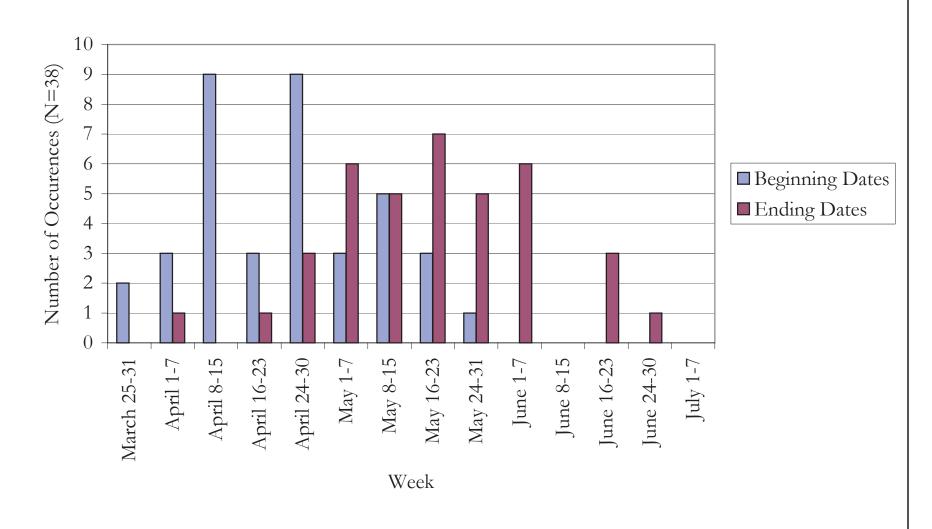
The HSI indices indicate that neither Silver, Caples or Echo lakes support high quality bald eagle nesting habitat, even in the absence of ice cover. Union Valley Reservoir where eagles attempt to nest also supports limited suitable habitat. The primary reason for the low HSI indices is the low natural productivity (SIVF) of each reservoir. Reproductive habitat and human disturbance indices are typically high.

#### **DISCUSSION AND ANALYSIS**

#### Lake Thaw Analysis

The lake thaw analysis results (Table 3 and Figure 4) indicate that Silver Lake, the first lake to begin thawing, typical begins thawing from the second week in April through the second week in May





SOURCE: EIP (2004)



FIGURE 4
BEGINNING AND ENDING LAKE
THAW DATES FOR SILVER LAKE
1966-2003

Table 3. Annual dates for the beginning and ending of lake thawing at Silver, Caples, and Echo lakes, 1966 – 2003.

	Begins	ning of Lake Th (calendar date)		Endi	ng of Lake Tha (calendar date)	wing <sup>2</sup>	Duration of Thaw
Year	Silver	Caples	Echo	Silver	Caples	Echo	(days)
1966	2 Apr	15 Apr	6 Apr	1 May	14 May	5 May	29
1967	22 May	3 Jun	26 May	20 Jun	2 Jul	24 Jun	29
1968	10 Apr	23 Apr	14 May	1 May	14 May	5 May	21
1969	29 Apr	12 May	3 May	24 May	6 Jun	28 May	25
1970	7 May	20 May	11 May	20 May	2 Jun	24 May	13
1971	15 May	28 May	19 May	7 Jun	20 Jun	11 Jun	23
1972	29 Apr	12 May	3 May	15 May	28 May	19 May	16
1973	27 Apr	10 May	1 May	23 May	5 Jun	27 May	26
1974	6 May	19 May	10 May	24 May	6 Jun	28 May	18
1975	14 May	27 May	18 May	7 Jun	20 Jun	11 Jun	24
1976	25 Apr	8 May	30 Apr	2 May	15 May	6 May	7
1977	15 Apr	28 Apr	19 Apr	5 May	18 May	9 May	20
1978	10 May	23 May	14 May	3 Jun	16 Jun	7 Jun	24
1979	5 May	18 May	9 May	30 May	12 Jun	3 Jun	25
1980	19 Apr	2 May	23 Apr	1 Jun	14 Jun	5 Jun	43
1981	14 Apr	27 Apr	18 Apr	10 May	23 May	14 May	26
1982	27 Apr	10 May	1 May	24 May	6 Jun	28 May	27
1983	22 May	5 Jun	26 May	23 Jun	6 Jul	27 Jun	32
1984	8 May	21 May	12 May	22 May	4 Jun	26 May	14
1985	11 Apr	24 Apr	15 Apr	10 May	23 May	14 May	29
1986	23 Apr	6 May	27 Apr	18 May	31 May	22 May	25
1987	15 Apr	28 Apr	19 Apr	28 Apr	11 May	2 May	13
1988	25 Mar	7 Apr	29 Mar	7 Apr	20 Apr	11 Apr	13
1989	13 Apr	26 Apr	17 Apr	7 May	20 May	11 May	24
1990	5 Apr	18 Apr	9 Apr	25 Apr	8 May	29 Apr	20
1991	8 May	21 May	12 May	22 May	4 Jun	26 May	14
1992	9 Apr	22 Apr	13 Apr	20 Apr	3 May	24 Apr	11
1993	28 Apr	11 May	2 May	25 May	7 Jun	29 May	27
1994	14 Apr	27 Apr	19 Apr	4 May	17 May	8 May	20
1995	26 May	8 Jun	30 May	18 Jun	1 Jul	22 Jun	23
1996	30 Apr	13 May	4 May	17 May	30 May	21 May	17
1997	25 Mar	7 Apr	29 Mar	30 Apr	13 May	4 May	36
1998	28 Apr	11 May	2 May	24 Jun	7 Jul	28 Jun	53
1999	28 Apr	11 May	2 May	1 Jun	14 Jun	5 Jun	34
2000	4 Apr	17 Apr	8 Apr	14 May	27 May	18 May	40
2001	23 Apr	6 May	27 Apr	9 May	22 May	13 May	16
2002	8 Apr	21 Apr	12 Apr	16 May	29 May	20 May	38
2003	21 May	3 June	25 May	3 Jun	16 Jun	7 Jun	13

Beginning of thawing occurs with substantial snowmelt. The lakes rise 3-6 feet to spillway elevation. Open water is around the edges of the lake comprises 20-30% of the lake surface.

Ending of thawing occurs when all snow around the lake margins is gone and the lakes are > 95% thawed.

Table 4. Breeding bald eagle habitat suitability model metrics for Silver, Caples and Echo lakes, and Union Valley Reservoir.

	Lake/Reservoir				
Metric	Silver	Caples	Echo	Union Valley <sup>1</sup>	
Food Component of the HSI Model					
Area covered by open water and adjacent					
wetlands (mi. <sup>2</sup> )	0.80	0.98	0.52	4.50	
Total dissolved solids (ppm)	7	12	6	18	
Mean depth (feet)	26	36	47	97	
Morphoedaphic Index (MEI) <sup>2</sup>	0.27	0.33	0.13	0.18	
SIV1 suitability index value	0.20	0.25	0.13	1.00	
SIV2 suitability index value	0.05	0.07	0.03	0.04	
SIVF suitability index value	0.10	0.13	0.06	0.20	
Reproduction Component of the HSI Model					
Percent of potential nesting area covered					
by mature timber	60	70	70	75	
SIR suitability index value	0.80	0.93	0.93	1.00	
Human Disturbance Component of the HSI M	odel				
Number of buildings or campsites per					
mi.2 of upland evaluation area	13	3	13	1.5	
SIHR suitability index value	0.76	0.95	0.76	0.98	
HSI Model (all components)					
Breeding habitat suitability index for bald					
eagles	0.08	0.12	0.05	0.20	

<sup>1</sup> Data for Union Valley Reservoir (2,850 acres) contained in various Sacramento Municipal Utility technical reports located on the Upper American River Project web site (<a href="http://hydrorelicensing.smud.org/">http://hydrorelicensing.smud.org/</a>).

(range in initiation of thaw dates: 25 March - 26 May; n = 38). The end of spring thawing is spread over a longer time period than the initiation of thawing, but typically ends between the first week in May and the first week in June (range in ending thaw dates: 7 April - 24 June; n = 38). As state previously, the end of the thawing corresponds to the beginning of the vegetative growing season. Snow has finally melted from slopes with a southern exposure and forbs and grasses desirable for grazing aquatic birds begin to grow. Prior to the onset of vegetation growth, grazing birds, one of the bald eagle's prey bases, do not occur at Silver Lake. Typically, by the end of May and early June, both mallards and Canada geese begin to arrive, with geese becoming numerous (EIP 2004c).

The lake thawing pattern is similar for Caples and Echo lakes, except that it occurs later in the season than Silver Lake. Caples Lake, the highest elevation lake of the three, does not begin thawing until nearly two weeks following the onset of thawing at Silver Lake. Thus, Caples Lake does not typically begin thawing until the last week in April through the last week in May. The end of the thaw and the beginning of the vegetative growing season at Caples Lake typically occurs between mid-May and mid-June.

Similarly, Echo Lake, which does not support bald eagle habitat, begins thawing about four days later than Silver Lake. In contrast to the three alpine reservoirs, Union Valley Reservoir does not

<sup>2</sup> The optimum MEI is approximately 40. See Detrich (1986: Figure 6).

freeze over during the winter period (David Hanson, Sacramento Municipal Utility District, *pers. comm.*, 2 April 2004). Nor does Lake Tahoe freeze where bald eagle nesting has also occurred.

The lake thaw analysis results indicate that the lake thawing periods do not synchronize well with the bald eagle reproductive cycle. Bald eagles in California begin nesting in March and April, when winter conditions still prevail at the three lakes. Adequate forage resources are perhaps the most critical components of bald eagle breeding habitat (U. S. Fish and Wildlife Service 1986). Bald eagles are typically flexible in their selection of nest sites as long as a dependable food resource is available in early spring (Peterson 1986: 4). In the case of Silver, Caples and Echo lakes, the late thawing of these reservoirs limits eagle forage resources, typically aquaphilic species, from being available when they would be needed for nesting. Also, persistent inclement weather into the spring can prevent successful nest establishment at higher elevations sites (Lehman 1981).

#### Breeding Season Habitat Suitability Index Model Analysis

The results of applying the U.S. Fish and Wildlife Service's breeding season HSI model to Silver, Caples and Echo lakes indicate that these lakes have a very low potential to support nesting eagles, even in the absence of ice cover. In examining the food component of the HSI model the results suggest that these reservoirs are relatively small when compared to typical waterbodies where eagles nest (SIV1). Therefore, there is a low open water and adjacent wetlands suitability index for Silver, Caples, and Echo lakes in contrast to Union Valley Reservoir which has an optimum open water and adjacent wetlands suitability index.

Of greater importance is the morphoedaphic index which measures lake productivity. The suitability indices for SIV2 are extremely low. Not surprisingly, none of the four reservoirs are very productive. The three alpine reservoirs have a very low dissolved solids concentration (approaching distilled water) and low nutrient content. The small size of each of the three lakes and the low productivity combine to produce an overall food suitability index that is low. Detrich (1986: 46-54) has found a positive relationship ( $r^2 = 0.947$ ) between bald eagle densities and lake productivity in California. The results indicate that, all other environmental factors aside, the three alpine reservoirs could probably not support nesting eagles during the breeding season due to low food availability.

Limited reservoir productivity (SIV2) may be major factor in the low productivity rate of the resident pair of bald eagles at Union Valley Reservoir. Nesting data from this reservoir (1986-2004) indicates that the eagles successfully nested in only 7 (or possible 8) of the 19 years of monitoring, or less than 42 percent of the time (Sacramento Municipal Utility District 2004: 7).

The three oligotrophic reservoirs where fishless under pristine conditions, and the current level of angler-use is supported by the routine stocking of fingerling and catchable trout by the California Department of Fish and Game during fishing season. The routine stocking of trout at each lake provides those eagles visiting during the summer period with a supplemental food supply that would not be otherwise available. Table 5 summarizes the 1998 stocking allotments at each lake. It is likely that many of the trout captured by visiting eagles during the late summer are stocked fish that are relatively easy to catch and that may have received angling injuries.

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able 5. Fish plant	ing records for Silver, Capl	es and Echo lakes for 199	78.
Lake	Trout Species Planted	Size Planted	Number Planted
Silver	rainbow, brown	catchables	25,800
Caples	rainbow, brook, brown,	fingerlings, catchables	
-	lake		59,500
Echo	rainbow, Lahontan	fingerlings, catchables	
	cutthroat		36,700

Source: Application for License, Volume 4. Exhibit E: Appendix F (10 February 2000).

The reproduction component of the HSI model indicates that each lake has the potential to support mature timber that could be used by bald eagles for nesting (SIR). While this may be true, a closer examination of the mature tree vegetative cover at each lake suggests that the suitability index results for reproduction may be overestimated. For example, at Silver Lake the tree cover type is predominately red fir. Red firs, while growing to a large size, have a pyramidal growth form (i.e., drooping branches), and a typically dense branching structure. Trees with this growth form are not well-suited for nest trees since they do not have the open canopy with large horizontal branches to support heavy nests. Of the 87 bald eagle nests examined by Lehman (1979: 8), none were located in red fir trees, although firs were in the area of some nests.

At Caples Lake, the tree cover type is predominately lodgepole pine (*Pinus murrayana*). These pines have a similar growth form to red fir. As a consequence, lodgepole pine may have limited desirability for eagle nesting. Lehman's study (Lehman 1979: 8) found one eagle nest located in a lodgepole pine out of the 87 nests examined.

Echo Lake does not support bald eagle nesting habitat according to the USFS. The predominate tree cover around Echo Lake is red fir. In contrast, the predominate tree cover around Union Valley Reservoir is ponderosa pine or a mixed conifer forest. Ponderosa and sugar pine are overwhelmingly favored by bald eagles for nesting due to their structural characteristics (Lehman 1979: 8).

Human disturbance does not appear to be a significant factor in determining nesting habitat suitability at the three lakes (SIHD). Human disturbance is moderate at Silver and Echo lakes, and near optimum at Caples Lake. Union Valley Reservoir also has a near optimum human disturbance index. Non-breeding bald eagles seem to habituate to most human activities provided there is no intentional perturbation (Knight and Knight 1984).

#### SYNTHESIS OF STUDY RESULTS

Consultation with Ron Jurek of the California Department of Fish and Game confirmed that lakes above 7,000 feet have a significantly lower potential for eagle nesting than lower elevation lakes, and that high elevation lakes are not considered as likely nesting habitat for bald eagles in California (Ron Jurek, California Department of Fish and Game, *pers. comm.*, 17 March 2004). Phil Detrich of the U.S. Fish and Wildlife Service confirmed that high-elevation lakes that remain frozen well into the

breeding cycle are not considered by the USFWS as bald eagle breeding habitat in California (Phil Detrich, USFWS, pers. comm., 27 February 2004). David Garcelon of the Institute for Wildlife Studies indicated that, though elevation is not, in itself, a critical determinant of eagle nesting in California, lakes that remain frozen into May and June do not provide adequate food resources needed for breeding, and by May and June, the female bald eagle is already coming out of her breeding cycle and not prone to nest establishment (David Garcellon, Institute for Wildlife Studies, pers. comm., 5 March 2004). Ron Jackman of The Santa Cruz Predatory Bird Research Group also clarified that elevation is not as much of a factor in nest site selection as the lakes being frozen, and that if frozen until late in the reproductive cycle, bald eagles would not be prone to nest at these locations (Ron Jackman, The Santa Cruz Predatory Bird Research Group, pers. comm., 27 February 2004).

The protocol bald eagle surveys and the subsequent evaluations indicate that bald eagles do not currently nest at Silver, Caples or Echo lakes, nor are the environments of these lakes conducive to eagle nesting, successful or unsuccessful. A summary of the collective scientific evidence follows.

#### Protocol-level Bald Eagle Surveys

Protocol level bald eagle surveys were conducted in 2000 and 2001. The findings are:

- No bald eagle nesting, nesting activity, evidence of nests, or recently fledged birds were found or observed in either year, indicating that nesting does not currently occur at any of the three reservoirs;
- The late thawing of the three alpine reservoirs demonstrates that the timing of the eagle surveys was appropriate for observations of late-term nesting and fledged birds to have been detected. Eggs laid from mid-April through mid-May would hatch between mid-May and mid-June. Fledged young would be observed between the end of July through October.
- Adult and sub-adult bald eagles do utilize both Silver and Caples lakes late in the summer period. These birds are visitors from other areas and they use the lakes as foraging habitat. By late summer, waterfowl abundance has increased and annual fish stocking has occurred, thus providing a forage base for these transient eagles. No eagles were observed at Echo Lake in either year;
- The results of the protocol–level surveys are consistent with the historical observations of the USFS over many years;
- The results of the surveys are consistent with the records included in the California Natural Diversity Data Base maintained by the California Department of Fish and Game; and,
- The survey results are consistent with the opinions, observations, and research of California's top bald eagle experts.

#### Lake Than Analysis Model

Thirty-eight years of lake thawing data indicate the following:

- The onset of lake thawing occurs too lake in the bald eagle breeding cycle to allow the eagles to nest at the three alpine reservoirs even after thawing is completed; and,
- The vegetative growing season does not begin until the end of the thawing period; thus, forage for grazing aquatic birds (prey base) is not available to attract the bald eagles to the lakes until late-spring.

#### Breeding Bald Eagle Habitat Suitability Index Model

This habitat quality assessment model developed by the U.S. Fish and Wildlife Service indicates the following:

- The three alpine reservoirs are relatively small in open water area and adjacent wetlands, thus limiting the number of eagles that can potentially use these waterbodies;
- The natural productivity of each oligotrophic reservoir is very low, thus significantly limiting natural fish production. Fish stocking does not begin until the trout season opens on Memorial Day weekend (about May 31); thus eagle access to the relatively easy to catch hatchery trout (prey base) is not available until then;
- While each reservoir has a surrounding tree cover that is significantly mature, and thus presumably usable by eagles for nesting, the occurrence of red fir (Silver and Echo lakes) and lodgepole pine (Caples Lake) suggests that nesting habitat may be limited, and possibly unsuitable;
- Human disturbance at all three reservoirs is expected to be moderate to very low. Future increases in human usage of each reservoir will not alter the habitat suitability index for this variable. Transient eagles will continue to utilize Silver and Caples lakes during the summer period.

In summary, the environmental factors that influence the suitability of Silver, Caples and Echo lakes for bald eagle nesting are the late occurrence of reservoir thawing and the late occurrence of the subsequent growing season. Even in the absence of ice cover, low lake productivity would severely limit the potential for bald eagle nesting at these locations.

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